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ABSTRACT

This publication accompanies the textbook entitled "Civil Aviation and Facilities," published in the Aerospace Education II series. It provides teacher guidelines with regard to objectives (traditional and behavioral), suggested outlines, orientation, suggested key points, suggestions for teaching, instructional aids, projects, and further reading for each chapter. A blank sheet is attached at the end of each chapter for recording teacher ideas. Page references corresponding to the textbook are given. (PS)

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INSTRUCTIONAL UNIT IV

CIVIL AVIATION AND FACILITIES

PREPARED UNDER
THE DIRECTION OF

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SE 017 463

JANUARY 1974

INSTRUCTIONAL UNIT IV

CIVIL AVIATION AND FACILITIES

INSTRUCTIONAL UNIT OBJECTIVES - When the book is completed each student should:

a. Understand the importance of the relationship between the Government and civil aviation.

b. Be familiar with the development of general aviation and the role it plays in present day society.

c. Be familiar with the activities and operations of commercial airlines.

d. Know some of the basic support facilities used at airports and in air traffic control centers.

e. Understand the importance of Air Traffic Control activities.

f. Understand the nature of civil aviation's major problems and possible future solutions.

INSTRUCTIONAL UNIT V CHAPTERS

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CHAPTER I - THE GOVERNMENT AND PRIVATE AVIATION

Chapter I presents a brief history of civil aviation that shows how the growth of military aviation coincided with developments in civil aviation. It stresses the role Government must play in aiding and regulating the air industry. Close cooperation between industry and the military is evident in the development of air resources during World Wars I and II. Civil aviation provides an essential base for air forces in our defense system. Consequently, the Government subsidizes the air industry to keep it thriving and strong. Chapter I shows the student that civil and military aviation are closely interrelated and that they have a long history of integrated activities. The student should appreciate the importance of the Federal Aviation Administration.

1. OBJECTIVES:

a. Traditional - Each student should:

(1) Be familiar with the history of civil aviation.

(2) Understand the need for Government regulation of the air industry.

(3) Know some of the activities of such Government agencies as the Civil Aeronautics Authority (CAA), the Civil Aeronautics Board (CAB), and the Federal Aviation Administration (FAA).

(4) Understand the significance of mutual support and cooperation between civil and military aviation.

(5) Know the role of the Civil Reserve Air Fleet (CRAF).

b. Behavioral - Each student should be able to:

(1) Recall several major events in the history of aviation and identify the key individuals associated with these events.

(2) Compare the need for an orderly and safe flow of air transportation to Government regulation of air mail, transportation rates, safety, and civil aviation support of military operations.

(3) Describe the purpos and functions of the CAA, CAB, and FAA in accomplishing regulatory and planning activities of civil aviation and list some of their activities.

(4) Summarize 4 contributions of civil aviation to our military defense system and at least 4 contributions by the military to private and commercial flying.

(5) Outline the role of the CRAF.

2. SUGGESTED OUTLINE:

a. The definition and early history of civil aviation

(1) Early historic flights

(a) American and European fliers

(b) The United States slowly acquires pilots

(2) World War I aviation

(a) Limited US air resources

(b) Postwar stimulus of former aviators

(3) The beginnings of air mail

(a) First air mail service routes and schedules

(b) Legislation and actions advancing air mail service

(4) The first airlines

(a) Early difficulties

(b) Government steps to promote commercial aviation

b. Civil Aviation since World War II

(1) Civil aviation support of the war effort

(2) Effects of postwar cutbacks

(a) The Civil Aeronautics Board Act

(b) Steps toward increase in airline passenger travel

(3) The beginnings of an aviation boom--1950

(a) "Crowded air"

(b) The Federal Aviation Agency

(4) Aviation safety

c. Relations between civil and military aviation

(1) The work of the FAA in promoting cooperation

(2) Project Beacon

(a) Purpose

(b) Recommendations and actions

(c) Air safety

(3) Civil Reserve Air Fleet (CRAF)

(a) Airlift assistance mission

(b) Three stages in activation

(4) The International Civil Aviation Organization (ICAO)

3. ORIENTATION:

Chapter I introduces the student to the study of civil aviation by first presenting a brief history of private and commercial aviation and then indicating how the Government, throughout this history, has been both dependent on and a benefactor of civil aviation. This places the aircraft world in its proper perspective for students who might otherwise miss the interrelationship of civil and military aviation. The chapter continues by discussing the role of different Federal aviation regulatory bodies in today's aerospace activities. Chapter I presents an excellent background for the study of the more specific aspects of civil aviation--private and commercial aviation, airports, and air traffic control--that follow.

4. SUGGESTED KEY POINTS:

a. A knowledge of the history of civil aviation does much to explain advances and achievements in military aircraft technology. In fact, the United States Government did not immediately realize the significance of the airplane to the national defense and transportation systems, and it was the private sector of our society that continued to promote interest in air power. After the Wright brothers' historic flight of 1903, the door was opened to a new wave of aviation enthusiasm. In Europe, governments sponsored races and offered prizes, and men like Santos-Dumont, Henri Farman, and Louis Bleriot accepted the challenges and improved their aircraft.

(Note: Some of the references for this chapter have been used for earlier coverage of aviation history. They have been cited here to aid you if your students either did not cover this material or need a review.)

** V-9002 pp 1-16
** V-9005 pp 11-15
** V-9012 pp 281-297
*** V-9014 pp 105-157
* V-9156 pp 640-657
*** V-9159 pp 11-47

By 1911 there were over 500 pilots in Europe, but in spite of the initial success of the Wrights, only 26 licensed fliers could be found in America. U.S. Government interest in pilots remained only in recruiting a few pilots, trained by the two brothers, for the Army Signal Corps. The Army Aviation Act of 1914 created the Aviation Section of the Signal Corps and authorized 60 officers and 260 enlisted men, but the Mexican border expedition of 1916 demonstrated that none of the Army's aircraft were suitable for combat. Meanwhile civilian aviators like "fastest-man-on-earth" Glenn Curtiss, and Calbraith Perry Rodgers were establishing new speed and distant records. When Rodgers flew 4,251 miles in 49 days from Long Island to Pasadena, the potential of the airplane was clearly demonstrated, and it was not long after his flights that the St. Petersburg-Tampa Airport Line opened regular passenger service. Still, American aviation lagged behind the rest of the world, and although Congress created the National Advisory Committee for Aeronautics in 1915, it was not a regulatory agency and did little toward establishing rules and regulations to govern civilian aviation.

b. World War I did much to spur aircraft production, at least during the war years, but British design and European know-how governed most of our industry, except for the American technological development of the famed Liberty Engine. The air industry increased production from fewer than 1,000 military and civilian planes to 11,000, and by the end of the war almost 9,500 men had been trained to fly the new weapons. After the war those pilots who wanted to continue flying found little to do except "barnstorm," but their entertainment did much to popularize flying. Army fliers did provide the Government with a means to initiate airmail service, and the first flight, between Washington and New York, occurred in 1918. At first uneconomical, the Post Office Department took steps to make airmail service competitive with the railroads by beginning night travel. The need for crosscountry landing fields, accurate navigation aids, and continual weather forecasts blazed a trail that commercial airlines would be able to follow. Transcontinental, day-and-night service, as well as all-weather flying, kept advancing airmail service in spite of rate increases, but it was the 1925 Kelly Air Mail Act that provided an economic basis for the air transport industry. By contracting private airlines to fly the mail, the act subsidized the existence of several aircraft companies. The Government took another big step in developing the Federal-civilian air partnership

** V-9002 pp 17-19
*** V-9012 pp 79-81, 297-300
* V-9014 pp 158-239
** V-9156 pp 658-685
*** V-9159 pp 133-143, 163-196

in 1926 with the Air Commerce Act, which gave the Department of Commerce the responsibility to build, maintain, and regulate the airways. But again it was the accomplishments of a private citizen--Charles A. Lindbergh--that led to an airline boom. His historic 1927 solo flight across the Atlantic induced many businessmen to consider the aviation industry as a source of investment. The Transcontinental Air Transport Company was formed with backing from Wright and Curtiss Aircraft and Pennsylvania Railroad, and Colonel Lindbergh headed the Technical Committee that mapped out and organized the coast-to-coast route. The big four airline companies (American, Eastern, TWA, and United) emerged from these early beginnings.

c. The final period in the early history of civil aviation began in the bleak days of the stock market crash of 1929. Although technological innovations, such as increased wing loading, multiengine craft, engine nacelles, cantilevered wings, and high octane gasoline, had brought about high performance planes (for instance, the Boeing 247, the Douglas DC-2, or the DC-3), loss of Government contracts, public fear of flying, and economic hardships had nevertheless restricted the development of the air industry. As in the past, Government legislation came to the aid. The Black-McKellar Bill of 1934 assigned the Interstate Commerce Commission the responsibility of establishing the rate of mail payments to air carriers and recommended that a study be made of commercial aviation. The Civil Aeronautics Act of 1938 established an agency to regulate the economy and safety of the industry and to promote air navigational facilities. In 1940 the Civil Aeronautics Authority became the Civil Aeronautics Board (CAB). On the eve of World War II, the airline industries had done much to advance passenger service and the Federal Government in turn had recognized that development of the airways was of prime national interest.

* V-9002 pp 19-20
** V-9012 pp 81-83, 300-304
** V-9014 pp 240-255
** V-9156 pp 685-699
** V-9159 pp 197-232

d. The need for Government regulation of the air industry has not always been readily apparent. As the early history of civil aviation indicates, the men in Washington did not always respond to the exploits of the men in the air. The National Advisory Committee for Aeronautics, the Kelley Air Mail Act, the Air Commerce Act, the Black-McKellar Bill, and the Civil Aeronautics Act were all important stages in the Government's growing concern over the air industry. The significant contributions

of civil air support and the immense technological advances during World War II decisively proved the need for Federal aid and regulation of aviation. When postwar cutbacks caused a financial crisis in the air industry, it was only because the Civil Aeronautics Board adjusted mail pay and approved many airline loans that the aircraft business survived the setbacks. By 1950, with a passenger fatality rate reduced to only 1.1 per 100 million passenger miles, the transport business showed a significant upturn. Air travel grew until today it handles more than 70 percent of all public domestic intercity traffic and accounts for billions of dollars each year of the gross national product. Of course, increased flights soon brought in "crowded air," which even today remains a serious and well-known problem. In 1958 the Government saw the need for legislation regulating airspace over the United States, and the Federal Aviation Agency was established to unify air traffic control. Since then the Federal Government has found other occasions when the need to mobilize civil air resources, promote aviation safety, or tackle new problems facing the air industry required the establishment of Government regulatory agencies or legislation.

*** V-9139 pp 3-19

e. Although for many years prior to the 1938 passage of the Civil Aeronautics Act Government agencies had regulated the airways and airlines, this statute introduced a new era of Federal involvement in aviation. The Civil Aeronautics Authority (CAA) consisted of three practically autonomous groups: a five-man Authority, a three-man Air Safety Board, and an Administrator. The CAA handled economic, safety, navigational, and promotional activities. Later split apart and placed under the Department of Commerce, the Civil Aeronautics Administration (still CAA) undertook the development of the nation's commercial and defense aviation needs while the Civil Aeronautics Board continued to handle safety rulemaking functions. During World War II, the CAA proved invaluable in coordinating and regulating civil air support, and after the war it was CAA assistance that insured the survival of our air industries. During the 1950s, the aircraft boom brought about "crowded air," which became one of the CAA's biggest problems. As the difficulty grew, Congress responded by establishing the Federal Aviation Agency (FAA) in 1958. This act brought together the CAA, the CAB, and the Airways Modernization Board. Assured

* V-9005 pp 114-115
** V-9012 pp 82-97
** V-9139 pp 14-40, 62-68

coordination and cooperation between civil aviation and military services was one of the most important accomplishments of the new agency. In 1967 the Agency became the Federal Aviation Administration (still FAA) and became part of the Department of Transportation. Today, the FAA offers intergroup assistance in the aviation field, radar advisory service for jet aircraft, and safety guidance designed to prevent traffic confusion in the airways. The FAA remains an important factor in our national defense posture.

f. Throughout Chapter I there are examples where civilian and military aviation have influenced one another or mutually supported one another. Early military aviation was dependent on civilian ingenuity and development, but on the other hand, pilots trained in the Army and equipment developed to meet wartime needs were great stimuli to private aviation during periods of peace. World War II demonstrated conclusively the defense establishment's reliance on the civil air arm. Civilian airlines provided the Armed Forces with transport aircraft, supplied key personnel and technical services, furnished contract flying assistance, trained flying personnel, and provided air base facilities as well as meeting the demands of the accelerated war industry. In recent years, the FAA has done much to coordinate military and civilian activities in the airways. Both civil and military representatives participated in Project Beacon, a scientific review of aviation. The project yielded practical long-range plans in the field of air safety. Joint military-civilian use of the Air Force's SAGE (semiautomatic ground environment) direction centers has provided excellent air traffic control above 24,000 feet. Civilian support of the national defense system is clearly evidenced in the activities of CRAF, the Civil Reserve Air Fleet, whose mission is to provide airlift assistance to the Department of Defense and civilian disaster relief agencies. CRAF provides airplanes and personnel for independent and immediate response to national needs. Fewer than 100 cargo and passenger aircraft may be needed to meet the requirements for the first stage. During the second stage (an airlift emergency as determined by the Secretary of Defense) many more aircraft would be made available to the military. The third stage calls for full activation of CRAF with more than 400 aircraft with crews.

** V-9123 pp 47-62
*** V-9139 pp 188-198

5. SUGGESTIONS FOR TEACHING:

a. Suggested time: 2-3-4 (Translation--if you teach two academic periods per week we recommend you devote two hours to this subject. If you teach three periods per week you could devote three periods. If you teach four academic hours per week you could devote four periods to the subject. These "Suggested times" are just that--recommendations. Adjust the emphasis according to interest and talent--both yours and the students'.)

b. As with many units, Unit 5 begins with a historical introduction. You should exercise caution in covering the history of aviation areas. Some of this material will have been covered in earlier texts and the time spent should be adjusted to the background of your students. This section of Chapter I covers seventy years of Federal and civilian aviation. A lecture that discusses facts and figures chronologically--emphasizing cause and effect--remains the standard method of presenting this type of information. Speaking techniques that cultivate student enthusiasm and response depend a great deal on the capabilities and interest of both the teacher and his class; you probably have already had considerable practice. Nevertheless, several things cannot be overemphasized. Know your material well enough that you do not have to rely constantly on your notes. Keep an eye out for places in your presentation where anecdotes, personal reflections, or contemporary references will illustrate your key points and make them relevant to your listeners.

c. Much of Chapter I can be taught through classroom discussion and student presentations. Students could be assigned selected topics, such as different governmental aviation agencies, civilian aviation problems, or civil aviators and their accomplishments. Never use students to accomplish your own homework! Be prepared to offer them advice, references, and information about their research projects. Plan ahead; give students adequate time to locate materials. (Most Government agencies will provide booklets and handouts through the mails upon request. See paragraph 8, Further Reading, Chapters II thru V of this handbook.) A classroom discussion could easily center around the role of civil aviation in wartime. Should civil aviation be used for military missions? Which should have priority? Etc.

d. Although military regulations still prohibit females from flying for the Air Force, civil regulations have no such prohibition. You might have some of the girls enrolled research the role of women in the history of aviation. A report back to the class on their findings as well as a comparison of their role today might prove stimulating.

e. Textbook corrections:

Page 16--Transportation should be capitalized in line 6.

f. Student assignment:

Read pages 1-24.

6. INSTRUCTIONAL AIDS:

a. Films:

(1) FAA

(a) FA-602 A Plane is Born, 27 min, color, 1968.

(b) FA-612 Path to Safety, 20 min, color, 1967.

(c) FA-801 All It Takes Is Once, 25 min, color, 1969.

(d) FA-805 Restraint for Survival, 8 min, color, 1967.

(e) FA-905 Kites to Capsules, 5 min, color, 1969.

(f) FA-907 Today for Tomorrow, 14-1/2 min, color, 1969.

(g) FAN-105 thru 109 History of Flight--Wright Brothers, Parts I-V, 28 min each, B&W, 1971.

(h) WF-00-36 Aeronautical Oddities, 20 min, B&W, 1961.

(Note: Some FAA films are listed for more than one chapter as they are appropriate as support in several areas.)

(2) USAF

TF 5992 Unknown Thirty-Six Seconds, The Aircraft Accident Investigation Board, 35 min, color, 1968.

b. Pictures and Illustrations:

Many of the reference books have excellent pictures of early aircraft and aviators.

7. PROJECTS:

a. See textbook, page 24.

b. If your students have not already done so, a visit to an aviation museum is recommended.

c. Build and/or display models of early aircraft.

d. Try to find an aviation pioneer such as a barnstormer who will talk to the class.

8. FURTHER READING:

a. Your school library may contain books on the Federal Government that discuss Federal aviation agencies.

b. Aerospace Historian magazine.

c. Casey, Louis S., The First Non-Stop Coast-to-Coast Flight and the Historic T-2 Airplane. Smithsonian Annals of Flight, Vol. I, No. 1, Washington, D.C.: Smithsonian Institute Press, 1968. (Available thru GPO, $1.50)

d. Strickland, Patricia, The Putt-Putt Air Force, The Story of the Civilian Pilot Training Program and the War Training Service (1939-1944), Department of Transportation, FAA (GA-20-84), 1970.

e. V-9062, Great Flights.

f. V-9122, The Invention of the Aeroplane, 1799-1909.

g. V-9156, Aeroscience.

h. V-9159, Takeoff Into Greatness.

IDEAS FOR IMPROVEMENT OF THE TEXTBOOK AND/OR INSTRUCTOR'S GUIDE
AND TEACHING TECHNIQUES MOST EFFECTIVE FOR THIS CHAPTER.
TO BE COMPILED AT END OF TEXT AND SENT TO JRC

CIVIL AVIATION AND FACILITIES

CHAPTER II - GENERAL AVIATION

Chapter II takes a closer look at some of the aspects of civil aviation mentioned in Chapter I. Agricultural aviation, business aviation, instructional flying, recreational flying, and the air taxi service are all discussed. Throughout the chapter the fast growth rate of this segment of the aviation industry is emphasized. The Civil Air Patrol is also covered in this chapter because of its important mission of promoting safety and aerospace education, primarily through general aviation.

1. OBJECTIVES:

   a. Traditional - Each student should:

      (1) Know some of the types of flying accomplished in general aviation.

      (2) Know why general aviation is very important and is growing fast.

      (3) Be familiar with the organization, purpose, and functions of the Civil Air Patrol.

   b. Behavioral - Each student should be able to:

      (1) Describe the purpose and activities of agricultural, business, instructional, recreational, and short-haul transportation flying.

      (2) Compare the scope of general aviation to military and airline flying.

      (3) List several reasons for the size and growth of general aviation.

      (4) Identify the mission and functions of the Civil Air Patrol.

2. SUGGESTED OUTLINE:

   a. The definition of "general aviation"

      (1) Rate of growth

      (2) Categories of general aviation

b. Agricultural aviation

(1) Beginnings of crop dusting

(2) Uses of aerial spreading today

c. Business aviation

d. Instructional flying

(1) The Private Pilot's Certificate

(2) Learning to fly

e. Recreational flying

f. Air taxi service

(1) The need for short-haul transport

(2) Types of service

(3) Problems facing this growing industry

g. The Civil Air Patrol (CAP)

(1) The CAP mission

(2) CAP organization and membership

(3) CAP's relationship to the military

h. The significance of general aviation

(1) Opportunities of the future

(2) The incredible growth rate

3. ORIENTATION:

Chapter II makes the student aware of the immense significance of general aviation in the United States. The chapter indicates how general aviation plays an important supplementary role in commercial aviation, which is discussed in the next chapter. The student is given an opportunity to survey the numerous occupations available in this booming field, not only locally but nationally and internationally as well. Remember, many of your students will not have an aviation or Air Force background; for some, aviation will seem remote or even exotic. Chapter II is an excellent opportunity to place flying on a personal level for students who might otherwise never seriously consider this rewarding career field.

4. SUGGESTED KEY POINTS:

** V-9012 pp 47-65
* V-9013 pp 16-24

a. General aviation includes agricultural aviation, business aviation, instructional flying, recreational aviation, and air taxi service. It covers activities ranging from conservation of forests, power and pipeline patrols, public service flying, to automobile traffic monitoring. The pilot working with agriculture may be called upon to spray or dust for insects, and/or scatter seeds and fertilizer. In fact, airplanes were used in the cultivation of one out of six tillable acres in the United States during a recent year. Many farmers and ranchers have their own aircraft, which are useful in checking on crops or livestock. Business aviation is equally as diverse. The need to make face-to-face contacts and to accelerate communications and delivery has brought the business world solidly into aviation. Many companies have their own airplanes; others use chartered service. Executive pilots and aircraft are common at most large plants, and the FAA predicts that for the next 10 years business flying will remain the largest portion of general aviation. Of course, instructional flying is essential if business and agriculture are going to acquire the pilots they need. The FAA has established certain requirements and tests which the student pilot must pass to qualify for a Private Pilot's Certificate. Many people acquire a private license simply to enjoy sport or recreational flying, but another important area of small plane flying is the air taxi service. Airplanes are competing successfully with short-haul transportation, such as trains or buses. The US Postal Service uses almost every mode of air transportation to speed the mail. Through the use of regional terminals and zone improvement plan (ZIP) codes, the most speedy and efficient means of delivery are selected and coordinated with carrier schedules. Commuter traffic will continue to increase in the coming years; perhaps the airplane will play an important role in alleviating this heavy burden on our transportation systems.

b. General aviation is an integral part of the commercial world. In 1957 there were 66,520 aircraft in the general aviation fleet and 1,829 aircraft in the air carrier fleet. The ratio of general aviation aircraft to air carrier aircraft was about 40 to 1. In 1972 there were 135,000 aircraft in general aviation and 2,600 in the air carrier fleet, or a ratio of more than 50 to 1.

Estimates for 1980 indicate a ratio of 60 to 1. Also in 1972, more than 745,000 persons, including students, held active pilot certificates. This figure is expected to reach at least 1,250,000 by 1982. Small aircraft production is booming and new landing facilities are being added continually to the over 12,000 general aviation airports already in operation. In the future, more and more communities will have to have aviation facilities. This in itself offers an excellent opportunity for enterprising aviators.

c. The Civil Air Patrol conducts a wide variety of activities, many related to general aviation. Its mission is four-fold: (1) to employ its volunteer manpower resources and equipment in search and rescue; (2) to fulfill its role of readiness to meet local and national emergencies; (3) to motivate the youth of America to the highest ideals of leadership and public service; and (4) to further the nation's air and space supremacy through a systematic aerospace education and training program. CAP is a civilian auxiliary of the United States Air Force. It is comprised of cadets and senior members of both sexes and is not restricted to any particular part of the country or specific type of mission. CAP offers courses to its members that are similar to AFJROTC, including practical lab experiences in the aerospace field. CAP is best known for the many missions of mercy members fly each year for downed aircraft or others in distress. Flights, squadrons, groups, and wings all over the country provide emergency airlift services to local communities.

V-9148
pp 315-316

5. SUGGESTIONS FOR TEACHING:

a. Suggested time: 1-2-3

b. Chapter II will probably be easier to present through active class participation than through lectures. Several different categories of general aviation are to be studied. Students could be assigned projects within these areas: collecting illustrations or pictures of aircraft used in each field, giving examples of local general aviation activities, or simply discussing the importance and function of each type. Be sure the presentations illustrate the size and importance of general aviation.

c. Have the class plan an urban center for the 1990s, proposing a wide use of advanced general aviation aircraft. Make a list on the blackboard of all the aerospace possibilities. Do not be afraid of the fantastic--aviation has fooled a lot of people since 1903.

d. If any of your students have flown or have a private pilot's license, have them describe both the training program and their impressions of flying.

e. Discuss current problems affecting general aviation such as the 1973-74 fuel shortage. Both the General Aviation Manufacturers Association (GAMA), Suite 1215, 1025 Connecticut Ave., NW, Washington, DC 20036, and the Aviation Distributors and Manufacturers' Association (ADMA), 1900 Arch Street, Philadelphia, PA 19103 supply a wealth of materials regarding general aviation.

f. Chapter II offers an excellent opportunity to conduct a field trip. There are undoubtedly agricultural, business, or recreational aviation operations near your community, and possibly a CAP unit. A well-planned orientation tour of a local airport would provide real excitement for your class (see V-9148, pp 209-215). Plan ahead! Representatives of different types of general aviation activities as well as airport personnel will usually be more than happy to conduct a tour. An alternate plan would be to plan an airport trip in conjunction with your study of Chapter IV.

g. Textbook correction:

(1) Page 27, Fig 6, dirigible is misspelled.

(2) Page 28, Fig 7, dirigibles is misspelled.

(3) Page 31, line 2, should be "fly-ins."

h. Student assignment:

Read pages 25-35.

6. INSTRUCTIONAL AIDS:

Films:

a. FAA

(1) FA 01-73 General Aviation--Fact or Fiction, 14-1/2 min, color, 1973.

(2) FA-705 Flying Clubs, 20 min, color, 1969.

b. Piper Aircraft Corporation
Film Department
Lock Haven, PA 17745 (you pay return postage)

(1) Don't Tell My Wife, 19 min, color, 1965.

(2) Flight of the Bluebird II, 26 min, color, 1968.

c. USAF

SFP 1245 Air Power in National Development, 20 min, color, 1966.

7. PROJECTS:

In addition to the suggestions in the textbook, students may like to start an aircraft file, using photographs or illustrations of different airplanes used in general aviation. Each card would also contain performance capabilities.

8. FURTHER READING:

a. Current periodicals furnished by AFJROTC.

b. "Short-Haul Transportation Problems and Promises," pp 8-11 in Aerospace, January 1972. Published monthly by Aerospace Industries Association.

c. If you have students who plan to start flying, several items in the AFJROTC reference library are recommended, e.g., V-9090, V-9156, V-9161, V-9162, and V-9187.

d. Reference library materials supporting the subject of general aviation are limited, but there is a wealth of free materials available from the aviation industry.

e. Cessna Aircraft Company, Air Age Education, P.O. Box 1521, Wichita, Kansas 67201, has published five small booklets titled (1) "The Flying Machine: First Cousin to the Birds";

(2) "Come Fly With Us"; (3) "The Magic of Making Airplanes"; (4) "The Flying Bug and How It Bites"; and (5) "What Are You Going to do With the Next Half Century?". One copy of each of these booklets was furnished to each unit. While they are excellent support material for many parts of the Aerospace Education curriculum, they are probably most useful as support for this chapter.

IDEAS FOR IMPROVEMENT OF THE TEXTBOOK AND/OR INSTRUCTOR'S GUIDE
AND TEACHING TECHNIQUES MOST EFFECTIVE FOR THIS CHAPTER.
TO BE COMPILED AT END OF TEXT AND SENT TO JRC

CIVIL AVIATION AND FACILITIES

CHAPTER III - COMMERCIAL AIRLINES

Chapter III discusses another large segment of civil aviation. The commercial airlines are vital to our national economy, and the Government, through the Civil Aeronautics Board and Federal Aviation Administration, has an important role in regulating airline activities. A portion of the chapter is devoted to studying the phenomenal growth rate of this industry and the prospects for the future. The discussion of airline rates, schedules, connections, and aircraft should be of personal concern to the student. The nature and purpose of air freight is also covered. Finally, the chapter includes a survey of some of the major problems airlines face and must conquer. The chapter concludes with some possible solutions, including a look at the field of VTOL/STOL aircraft.

1. OBJECTIVES:

   a. Traditional - Each student should:

      (1) Know the role of Government in regulating the airlines industry.

      (2) Be familiar with the size, technological advances, and expanded passenger services that portray the rapid growth of commercial aviation.

      (3) Know the importance of air freight to the aviation industry and how it affects our lives.

      (4) Know at least two major problems facing the airlines industry today and some of the proposed solutions for tomorrow.

   b. Behavioral - Each student should be able to:

      (1) Outline the responsibilities and activities of the FAA and CAB regarding airlines safety and efficiency.

      (2) List at least six requirements placed on commercial aviation by CAB and FAA in order to control airline operations.

      (3) Discuss airline growth in terms of size, technological advances, and expanded passenger services.

      (4) Define air freight and outline its benefits.

      (5) Describe at least two problems facing the airlines industry today and some solutions that may possibly alleviate these difficulties.

2. SUGGESTED OUTLINE:

a. Commercial airlines today

b. Government regulation of the air industry

(1) CAB responsibilities

(a) The "certificate of public convenience" and its requirements

(b) Requirements placed on airlines by CAB

(c) Proposals to the Board

(2) FAA responsibilities

(a) Insuring airline safety--requirements

(b) Safety accomplishments of the industry

c. Airline management

(1) Comparative rate of growth

(2) Expansion in capabilities and related activities

(3) Air travel

(a) The value of mobility

(b) Promotional fares

(c) Air charter service

d. Impact of the jet age

(1) Technological advances

(2) Jets replacing pistons

(3) Considerations for airline equipment decisions

(a) The need to modernize

(b) Development of efficient subsonic aircraft capacities and performance

e. The supersonic transport (SST)

f. Sources of funds

g. Airline routes

h. Air Freight

(1) Aircraft freighters and the quantity of operation

(2) What air freight must provide

(a) Capacity to meet freight traffic

(b) Efficient, quick-haul operations

(c) Coordination of land and sea transfers

(d) Advanced, efficient invoice techniques

(e) Competitive freight rates

(f) Ability to meet unexpected situations

(3) Major air freight problems

i. Management problems

(1) Passenger schedule inconveniences

(2) Air piracy

j. Outlook for the future

(1) Airport design

(2) New aircraft

(3) New types of aircraft--VTOL and STOL

3. ORIENTATION:

The objective of Chapter III is to make the student fully aware of the magnitude of commercial aviation, the necessity for Government regulation, and the nature of the major problems the industry faces. The chapter complements the preceding chapter, and together they build an introduction to the more specific topics covered in the succeeding chapters on airports and air traffic control. The student also learns something about airline rates, promotional fares, scheduling, and freight, which should be of personal interest. The chapter

concludes with a discussion of today's air traffic problems, a consequence of the airline boom and a matter of great national concern. Overall, the chapter should cultivate an active interest in an ever-growing industry that offers many challenges and rewards.

4. SUGGESTED KEY POINTS:

a. As indicated in Chapter I, the need for Government regulation of civilian aviation brought about the establishment of a Federal Aviation Administration (FAA) and a Civil Aeronautics Board (CAB). The public need for an honest, efficient, and economical system of air transportation, as well as the need for safety, meant that CAB had to establish rigid eligibility restrictions and requirements covering airline operations. Today, scheduled airlines must serve all points designated on its certificate with regular, reliable service. Fares and tariffs must be in the public interest, and CAB insures that these, as well as flight operations, are standard through quarterly reports on service, traffic, and finances. Moreover, airline records and facilities are subject to CAB inspection at any time. Nevertheless, the CAB is more than just an airways watchdog. In a spirit of mutual cooperation, the CAB considers rule change proposals that would aid the industry as a whole. The FAA's prime responsibility is publishing and enforcing safety regulations. With the airways packed with traffic, the danger of collision can only be prevented through established flight routes. The FAA insures that aircraft dispatchers, who monitor airplane flight paths, are highly qualified technicians. They must be thoroughly familiar with routes, weather conditions, navigational facilities, and airport operations. Furthermore, the reliability of navigational aids is checked and approved through FAA inspections. All airlines personnel must meet high standards of competence, especially flight captains. Routes and equipment are checked and double checked before the lives of passengers become involved. The FAA's minimum safety standards are very high, as is evidenced by an accident rate that has dropped to less than 1 passenger fatality per 300 million passenger miles. The airlines themselves have responded to the challenge of safety, and they have shown considerable leadership in the development of new safety devices and procedures. Although the text cites flying is 7-10 times safer than driving, current statistics indicate it is actually about 20 times as safe.

* V-9001, Pt 4 pp 2-6
* V-9002 pp 283-291
* V-9005 pp 114-119
* V-9012 pp 35-36, 82-89
** V-9013 pp 634-646
** V-9123 pp 1-23
* V-9139 pp 20-28, 38-40, 62-68, 107-125
* V-9187 pp FAR 1-22, AS 1-10

b. Commercial aviation has truly boomed in recent years. Unquestionably, the seven-fold increase the air industry has made since 1950 is unique in recent business history. Large outlays of capital funds have enabled airline companies to expand in pace with the ever growing passenger and freight market. What is the reason for this phenomenal growth? Today, business, more than ever before, needs face-to-face communications. The national economy requires rapid transportation, and the airlines have been able to meet the requirements through radical technological improvements. The public receives greater speed, comfort, convenience, as well as reliability, in today's airborne system of travel. Constant public demand for higher standards has stimulated constructive competition between airlines. Competition, in turn, has brought about greater efficiency, and efficiency means lower rates and tariffs, increasing the market and requiring the airlines to expand their capacities. The 1973-74 fuel crisis led to even more efficient operations; however, there was also some reduction in services. Promotional fares have been a real inducement to travel-hungry Americans. Excursion rates, tourist class fares, round trip deductions, charter service, and many other economy measures have flooded the market with special discount reductions in cost. Increased passenger loads and scheduled flights are two ways the industry has met the explosion in demand. Transcontinental jet aircraft are found on the runways of airports throughout the country; in fact, about half of the world's air passenger traffic is carried by our big four--American, Eastern, TWA, and United, plus Pan American. By 1965 jets and turbo-props outnumbered piston planes in the airline fleet. The quality of new aircraft has kept pace with the quantity. Technological improvements continue to contribute to the advancement of commercial aviation.

** V-9012 pp 32-35,

c. Advances in aeronautical engineering are making both passenger and freight transport more economical. The Air Force's C-5 can carry freight ranging from missiles, planes, and helicopters to trucks and tanks in addition to 75 men in a troop compartment. Boeing has developed a passenger version with a capacity of 490 seats--the 747. Aircraft with these capabilities will help reduce the strain placed on our crowded airways and airports. Increasing the load and speed abilities of aircraft is one way the airlines industry is meeting today's aviation problems. Supersonic jet transports that travel 3 times as fast as subsonic aircraft have been produced in Europe. The "Concorde", made jointly by the British

* V-9002 pp 398-412
** V-9139 pp 199-210

and French, and the Tu-144, made by the Soviets, are the only two supersonic passenger transports flying today. Public opinion against the US program to develop an SST caused the program to be dropped. One of the primary reasons for lack of American acceptance of the SST was the problem of noise pollution.

d. Air freight has become a vital part of the US economy. Tonnage is expected to increase from 5.3 billion ton miles in 1971 to 25 billion ton miles by 1982. The airlines have tended to stimulate growth by increasing capacity in advance of demand. Improved management, better packaging and containerization, and quick delivery have aided the industry to keep rates competitive while maintaining the capacity to meet unexpected surges in demand. The public has become accustomed to fresh foods and businesses have found they can increase profits by reducing stock levels. Air freight has made these things possible. However, this growing complex industry requires highly trained personnel not only to operate it, but also to anticipate and plan for changes in business practices and public demand.

** V-9012 pp 40-46, 66-78

e. The expansion of nationwide air travel in recent years has made the transportation and communication network of our country one of the best in the world, but this great asset has not been free of shortcomings. Traffic and scheduling problems plague most of our major airports. Unexpected delays and hold overs disrupt the best laid plans of many passengers each year. Having one's luggage misrouted or delayed has become a standard joke, while hijackers and dangerously overloaded holding patterns present a far more serious problem. Of course, unfortunate incidents of this nature are the exceptions to the many successful and enjoyable air trips completed daily. But with air traffic continuing to grow--New York's three air terminals already exceed a volume of 7,000,000 passengers per year--the airlines industry is presented with a great challenge. Fortunately, technological advancements feasible in the near future promise to solve many of these problems. Airport designers are working out plans to ease congested terminals. Developments in mobile lounges, heliports, and rapid airport-city transit systems are just a few things that the future holds in store. Efforts to reduce the threat of air piracy appear to be working. New aircraft designs meeting small and large load requirements will soon be on the market. The SST or supersonic transport is still one of these possibilities. At present

however, FAA regulations prohibit supersonic commercial flights over the continental US. In effect, the only supersonic flights available to Americans in the immediate future will be overseas flights. Many aviators feel that the development of an airplane with successful vertical takeoff and landing (VTOL) or short takeoff and landing (STOL) capabilities as well as high-speed horizontal flight potential will do much to alleviate airport problems.

5. SUGGESTIONS FOR TEACHING:

a. Suggested time: 2-3-4

b. Student interest in the airline growth should make it easy to promote discussion on this fascinating field. As with the chapter on general aviation, you may want to indicate the career opportunities available to your students in this area of aviation.

c. In discussing Chapter III, there are several key points that your students should fully understand. Naturally, they should comprehend the integral and vital role the air industry has in the national economy. Next, they should understand why the Federal Government must take an active role in regulating commercial aviation. Finally, they must appreciate the large problems the airlines industry must solve as well as some of the possible solutions. If student committees were assigned to report on these three areas, the essential items in Chapter III would be adequately covered.

d. A guided discussion concerning the slowdown in growth and the effects of the fuel shortage on the airline industry will enable you to relate the material to recent events. Students should be given assignments to prepare them for the discussion.

e. As this handbook was being written, several major air carriers were requesting CAB to eliminate reduced military fares. Have your students report on the status of promotional fares.

f. Plan a charter service trip for the high school graduating class. Include costs, schedules, hotel reservations, tours, etc.

g. Some companies such as Otis Elevator Company have developed automated baggage handling. Have some students find out how these work and discuss them with the class.

h. If the majority of your students have not flown on a commercial airliner, have those who have give a detailed account of their experiences.

i. Air piracy is an interesting subject for high school students. Brainstorm ways in which skyjackers can be thwarted. Be careful not to judge ideas during the brainstorming session, but do discuss the ideas after the session.

j. Air traffic pile ups, the related safety problems, and how these cost the airlines in good will and operating costs are excellent discussion topics.

k. Textbook corrections:

(1) Page 41, last paragraph, missing words are:

than
as large
the steel

(2) Page 60, line 2, the fourth word should be: known.

l. Student assignment:

Read pages 37-64.

6. INSTRUCTIONAL AIDS:

a. Films:

FAA

(1) FA 02-72 Safety in the Skies, Above All, 10 min, color, 1972.

(2) FA-601 The Other Passenger, 30 min, color, 1965.

(3) FA-602 A Plane Is Born, 27 min, color, 1968.

(4) FA-709 A Place to Land, 20 min, color, 1968.

(5) FA-907 Today for Tomorrow, 14-1/2 min, color, 1969.

b. Filmstrip:

Filmstrip No. 5, "Jet Flight" from the Jam Handy filmstrip series Aircraft--Their Power and Control. These can be purchased individually ($15.00 each) or as a set, with cassettes (#JH5960 FC, $90.00) or with records (#JH5960 FR, $84.00) from: Scott Education Division, 104 Lower Westfield Road, Holyoke, MA 01040. This filmstrip depicts the steps in an airline flight and may be too elementary for your students.

7. PROJECTS:

a. See textbook page 64.

b. Visit an airline office or have a representative come speak to the class.

c. Collect mementos, such as matches, napkins, wings, etc. from as many airlines as possible. A restriction could be that some class member must have flown with that airline.

d. Write to the Air Transport Association of America, 1709 New York Ave, NW, Washington DC 20006, asking for information about commercial aviation.

8. FURTHER READING:

a. The best source of information for this block is periodical literature such as Aviation Week and Space Technology, Aerospace (published monthly by Aerospace Industries Association), Skylights (furnished free to members of the National Aerospace Education Association) and publications by the Air Transport Association.

b. Most of the reference library materials on this subject tend to become outdated rather quickly. We have been informed that FAA Annual Reports are no longer available. However, Civil Aeronautics Board Reports to Congress, FY 72 is available thru GPO for $.95.

c. The National Aviation System Plan, Ten-Year Plan 1973-1982. Department of Transportation, Federal Aviation Administration, March 1973. Available thru GPO, Stock No. 5007-00191, $2.60. Perhaps your school librarian would purchase this annually if your students are sufficiently interested.

d. V-9159, Takeoff Into Greatness.

IDEAS FOR IMPROVEMENT OF THE TEXTBOOK AND/OR INSTRUCTOR'S GUIDE
AND TEACHING TECHNIQUES MOST EFFECTIVE FOR THIS CHAPTER.
TO BE COMPILED AT END OF TEXT AND SENT TO JRC

CIVIL AVIATION AND FACILITIES

CHAPTER IV - AIRPORTS

Chapter IV covers the hub of air travel activity--the airport. The efficiency and attractiveness of an airport has a direct bearing on the success and comfort of air passenger service. This chapter begins with a short history of the development of airports, once simply "air fields" but now vast complexes of aviation wizardry. The modern airport must meet demanding FAA standards to operate, but the technological requirements of today's advanced aircraft already necessitate the highest quality mechanical and electronic equipment and facilities available. Nevertheless, airports are by no means free of problems, and Chapter IV concludes by discussing some of the difficulties facing the nerve centers of our nation's air traffic.

1. OBJECTIVES:

   a. Traditional - Each student should:

      (1) Know the essential facilities common to all modern airports.

      (2) Understand the important role of the airport in today's commercial and transportation network.

      (3) Be familiar with the major technological requirements and problems created by contemporary aircraft.

   b. Behavioral - Each student should be able to:

      (1) Describe the main operational facilities of a typical airport.

      (2) Explain the function of the airport in handling and coordinating air and ground traffic.

      (3) Identify the major technological requirements and problems created by contemporary aircraft.

2. SUGGESTED OUTLINE:

   a. The evolution of airports

      (1) Early "fields"

      (2) Federal Airport Act of 1946

      (3) Airports today

b. Standards for construction and operation

(1) Airport capacities

(2) FAA airport classifications

c. Location of airports

(1) Community aviation needs

(2) The National Aviation System Plan

(3) Airport construction considerations

(a) Geological conditions

(b) Additional development needs

(c) Joint general aviation and airline usage

(d) Airport configuration capacity

d. Airport facilities

(1) Runways

(a) Requirements for heavy aircraft

(b) Runway and taxiway patterns

(2) Airport lighting

(a) Beacons

(b) Approach lighting

(c) Runway lights

(d) Obstruction lights

(3) Control towers

(4) Terminals

(a) Passenger requirements

(b) Centralized and unit operation concepts

(c) Consolidation of operations

(d) Cargo and passenger loading requirements

e. Noise control and safety

f. Cargo terminals

(1) Design

(2) Automation

g. Airport improvements

3. ORIENTATION:

The student has studied some of the broad aspects of civil aviation and government aviation regulations. The next two chapters examine some more specific features of flying modern aircraft. Chapter IV treats a topic about which most people have some visual knowledge but little detailed information. The chapter discusses modern airport facilities and operations. The airport, as the nerve center of civil aviation, deserves special attention.

4. SUGGESTED KEY POINTS:

a. Airports began simply as pastures and flat beaches. Today the airport is a complicated network of activities and facilities. Beginning with the Federal Airport Act of 1946, continuous government expenditures on airport improvements have substantially broadened and raised the quality of aircraft ground support facilities. The National Aviation System Plan for the period from 1973 to 1982 envisions the expenditure of $2.8 billion for airport development assistance by 1982. These expenditures will go toward improving certain standard features of airports as well as construction of new ones.

* V-9065 pp 195-200
*** V-9139 pp 143-147

(1) Airport runways are relatively new due to the heavier aircraft produced after 1940. The greater weight of the new airplanes made them less sensitive to surface winds than the first aircraft, but planners had to consider the load-bearing requirements of the runway's surface and take-off and landing runway length requirements. Most early runways were covered with asphalt, but the extremely high tensile strength of concrete has made this the

** V-9161 pp 3-1 to 3-6

primary construction material today. The heavy air traffic burdening our airports has necessitated high-speed turn-off lanes. Taxiway patterns leading to and from the apron area also must be designed to allow the smooth and rapid flow of traffic.

** V-9139 pp 147-150

(2) Airport lighting became an essential feature of all landing sites with the advent of night flying.

(3) The control tower is a well-known feature of the airport skyline. The control tower operators have the important function of traffic control both in the air and on the ground.

(4) Passengers come in contact with airport terminals more than any other air facility. Waiting rooms, newsstands, snack bars, and concessions are provided for passenger convenience, but terminals also often contain a flight service station, a Weather Bureau office, and a post office. Where there is international traffic the terminal will also have customs, immigration, public health, and Department of Agriculture stations.

(5) Two basic concepts of terminal building operations are used today--centralized and unit operation. A consolidation of these two concepts is also possible. "Centralized" terminals arrange passenger, ticketing, and baggage facilities of all airlines in the same building. In a unit operation, each airline is housed in a separate building with its own facilities. All large terminals must have an effective scheme for systematic and orderly loading and unloading of aircraft. Finger corridors and/or mobile lounges are often used to deplane and enplane passengers. All terminals must also provide adequate measures for noise and safety control. Finally, airports handling freight must provide a cargo terminal with capabilities to match the tremendous lift potential of today's cargo aircraft.

b. The airport is the nerve center of the nation's air traffic; it is also a hub in a vast network of transportation. The National Aviation System Plan for 1973-1982 lists approximately 12,400 existing civil airports in the United States, of which 3,040 are included in the National Airport System. Air transportation today is as dependent on these public airports as on the aircraft

** V-9012 pp 98-104
* V-9123 pp 63-72

themselves. The FAA classifies airports in the US into three broad functional categories or systems. These are the primary system, the secondary system, and the feeder system. Each system is further graded according to density, or the annual number of passengers enplaned and aircraft operations/movements. How well an airport can carry out its responsibility and serve the public depends a great deal on location. Air transportation has had a great influence on the economic advancement of the country, increasing the accessibility of natural resources, labor supply, and markets. If a community does not have adequate airport facilities, it deprives itself of an important economic benefit. Furthermore, airports must have sufficient capacity to handle the needs of the community. Most of the nation's passenger flow is handled through large air traffic terminals while smaller terminals usually restrict nonstop flight to no more than 300 miles. All major airports add to the urban development of the community because of the hotels, stores, shops, restaurants, and resorts that cluster around airports. If factories are attracted, an airport industrial park may be created.

c. The airlines boom, as discussed in Chapter III, has placed heavy demands on the nation's airports. Technological advances on the ground have not always kept pace with advances in the air. Furthermore, the future promises to be even more challenging. Understandably, airports are faced with problems. The airport's responsibility to insure that our crowded airways remain safe is being severely tested and is of major concern to the airlines industry. (Chapter V will discuss air traffic control.) Less serious airport problems, nevertheless, pose considerable inconvenience for airline passengers. Inadequate parking space, crowded terminal services, too few public conveniences, long corridors leading to airplanes, aircraft traffic jams, and lost luggage are a few of the major dilemmas facing today's passengers. Meanwhile, many local communities are constantly upset due to aircraft noise. Hopefully, new aircraft and airport designs and improvements will eliminate many of these problems.

*** V-9012 pp 104-112
** V-9139 pp 150-155

5. SUGGESTIONS FOR TEACHING:

a. Suggested time: 2-3-5

b. Students will probably have more general information about Chapter IV than any other phase in this block of instruction.

This should make it easier to encourage class discussion. Students should be able to diagram different airports on the chalkboard or illustrate different airport facilities with pictures. Or they may design their own future airport and facilities. Be sure your students understand the importance of the airport to the community and to air traffic activities.

c. Airports are not free of major problems. Airport problems would be an excellent focal point for a panel discussion. Airport zoning or how to handle 490 passengers if a 747 has a weather delay are two possible departure points.

d. Chapter IV presents the most obvious opportunity for a field trip--to an airport. As stated before, be sure to plan your tour carefully in advance.

e. Textbook corrections:

(1) Page 71, Figure 21, the feeder system total in the In Being, 1973 column should be 2796, not 2396.

(2) Page 88, Figure 32, new primary system airport percentage for 1978-82 should be 60.0, not 60.5.

(3) Figures 21 (page 71) and 32 (page 88) do not reflect the latest data. While the text was at the printers, the new National Aviation System Plan was published. The new projected national system total for 1982 (Fig 21) is 4,087. The new plan calls for $2.8 billion in assistance for the ten-year period, not 2.55, with more emphasis on existing airports, 51.7%, and less on new airports, 48.3%. Also, total aid for the Airport Development Program has been increased from $2.7 billion to $2.95 billion (printed as "2,700" in figure 32).

f. Student assignment:

Read pages 65-90.

6. INSTRUCTIONAL AIDS:

Films:

a. FAA

(1) FA-02-71 Can We Have A Little Quiet Please?, 14-1/2 min, color, 1971.

(2) FA-02-72 Safety In the Skies, Above All, 10 min, color, 1972.

(3) FA-06-72 Airports Mean Business, 28 min, color, 1972.

(4) FA-609 It Pays to Stay Open, 23 min, color, 1966.

(5) FA-706 Airports in Perspective, 15 min, color, 1968.

(6) FAC 121 Dulles International--Port of the Future, 14 min, color, 1965.

b. Montana Aeronautics Commission
P.O. Box 1698 (four weeks notice,
Helena, Montana 59601 pay return postage)

Montana and Its Aircraft, 28 min, color, 1968.

7. PROJECTS:

a. See textbook, page 90.

b. If it was not done earlier, a research project on aircraft pollution is an excellent class assignment. A comparison of aircraft air pollution to automobile pollution will prove enlightening. Perhaps the findings could be presented before an assembly or put in the school newspaper.

c. A contest to design the best airport might be appealing. Be sure to get pictures for the local paper and properly recognize the best entries.

8. FURTHER READING:

a. See Further Reading for Chapter III of this handbook, items a, b, and c.

b. Airport Master Plans, AC 150/5070-6, February 1971, FAA. Available thru GPO, $2.00.

c. Johnson, G., Abominable Airline, New York: MacMillan, 1964.

IDEAS FOR IMPROVEMENT OF THE TEXTBOOK AND/OR INSTRUCTOR'S GUIDE
AND TEACHING TECHNIQUES MOST EFFECTIVE FOR THIS CHAPTER.
TO BE COMPILED AT END OF TEXT AND SENT TO JRC

CIVIL AVIATION AND FACILITIES

CHAPTER V - AIR TRAFFIC CONTROL

In this chapter, the student should learn about the control and navigation aspects of civil aviation. It begins with a brief history of air traffic control, indicating how primitive visual navigation systems evolved into vast networks of electronic navigational equipment. The chapter continues with a simulated flight under various conditions, illustrating the routine activities of a pilot. This section of the chapter discusses some navigational and guidance instruments and equipment. Aircraft instruments are covered in more detail in Theory of Aircraft Flight and Air Navigation. The future of air traffic control is bright although the heavy volume of aircraft in the sky makes the problem more difficult than ever. The chapter concludes with a discussion of proposals for future solutions to air traffic problems.

1. OBJECTIVES:

   a. Traditional - Each student should:

      (1) Be familiar with the development of civil aviation's air traffic control capabilities.

      (2) Know how ATC controls and assists air traffic.

      (3) Know the routine flying procedures used concerning guidance and navigation.

      (4) Be familiar with both the problems and planned solutions for air traffic control.

   b. Behavioral - Each student should be able to:

      (1) Recall the history and advancement of air traffic control systems and related navigational aids.

      (2) Describe at least four ways pilots and Air Traffic Controllers monitor an aircraft's position.

      (3) Outline the usual navigational and guidance activities conducted by a pilot in a routine flight, including an explanation of ground equipment used to assist aircraft and monitor air traffic control.

      (4) Discuss at least four innovations being considered to help solve some of the air traffic control problems.

2. SUGGESTED OUTLINE:

a. The importance of air traffic control

b. The development of air traffic control

(1) The navigational needs of the airmail service

(2) The advent of the radio

(3) Development of the airways

(4) The establishment of traffic control offices

(5) The Bureau of Air Commerce control of air traffic (1936)

(a) The Civil Aeronautics Act (1938)

(b) The transfer of air traffic control to the Civil Aeronautics Administration (1940)

(6) Post-World War II air traffic control advancements

c. A simulated flight using air traffic control

(1) Planning the flight

(a) Determining weather conditions

(b) Filing the flight plan

(c) Pre-flight inspection and radio communications for taxi and takeoff

(2) Piloting in ideal conditions (VFR)

(a) VOR navigation

(b) Reporting to Flight Service Stations

(c) Checking the TO-FROM indicator

(d) Tactical Air Navigation (TACAN)

(e) Approaching the next VOR transmitter

(3) Piloting by Instrument Flight Rules (IFR)

(a) Change from VFR to IFR

(b) The Air Route Traffic Control Center

(c) The use of radar in poor visibility

(d) The Air Traffic Control Radar Beacon Interrogator

(4) Flying under radar surveillance

(5) Landing

(a) Monitoring by Airport Surveillance Radar

(b) Making runway visual contact

d. A review of ATC facilities used during simulated flight

(1) Flight and weather information transmissions

(2) Takeoff clearance

(3) VFR and IFR flying

(a) The ARTCC controller

(b) The RAPCON controller

(4) FAA system of effective air traffic control

e. The future of air traffic control

(1) The increase in air traffic

(2) Need for more and better airports and facilities

(3) Plans for air traffic control improvements

(a) Communications

(b) Traffic handling

(c) Collision avoidance

(d) Improved radar and navigational devices

(e) Other improvements

f. Future importance of air traffic control

3. ORIENTATION:

Chapter V concludes the unit on civil aviation and the role of Federal regulation by examining the everyday activities of a civil aviator. Air traffic control comprises a large portion of all aviation operations. Technological advance and eventual control by Federal agencies were important steps in the evolution of civil aviation. The simulated flight contained in Chapter V illustrates the importance of avionics. The student, who at this stage of his education may identify mainly with pilots, should recognize the significance of navigational support from the ground. Closing with a discussion of the future of air traffic control, this chapter outlines the ramifications for the complete civil aviation picture.

4. SUGGESTED KEY POINTS:

a. In the initial years of civil aviation, air traffic control was practically nonexistent. Navigation was nothing more than visual identification of landmarks. But with the advent of airmail postal service and the need for all-weather flying, provisions were developed to help pilots locate their positions. A chain of radio stations, built between 1920 and 1921, broadcast the first weather information to American pilots. Night flying brought in a system of light beacons by 1926. The development of low and medium frequency radio ranges and the establishment of four electronically derived courses opened a new era in pilot navigation. This led to the establishment of airways (designated airspace for specified aircraft). The increase of airplanes using the airways necessitated reliable air traffic control systems. Flags, flares, and ground lights were not enough to guide pilots to their destinations. Airlines established their own traffic control offices with Bureau of Air Commerce approval. However, by 1936 it became obvious that only the Bureau of Air Commerce was capable of handling traffic control and air navigation support. The 1938 passage of the Civil Aeronautics Act, which consolidated various Federal regulating agencies in the aviation field, opened a new, advanced era of air traffic control. In 1940 air traffic control came under the jurisdiction of the Civil Aeronautics Administration (CAA) within the Department of Commerce and in 1958 the Federal Aviation Act incorporated the CAA into the Federal Aviation Agency. Fortunately, in recent years the rapid increase in air traffic has been accomplished by advances in navigational technology. Several high-level Government task forces, such as Project Beacon, have examined air traffic control problems and made recommendations for future development.

* V-9012 pp 270-276
** V-9139 pp 3-19, 69-82

b. Air traffic control and FAA navigational support play a major role in every flight. Weather conditions are of primary concern to every pilot, and hundreds of FAA and Weather Bureau facilities scattered across the country provide frequent and reliable forecasts. Teletypewriter systems relay weather information to airport weather facilities. After gathering weather information, the pilot must file a flight plan to alert Flight Service Stations (FSS) along his route. They will have additional weather and safety information for the aircraft and will monitor its progress. An aircraft is released for takeoff by the controller in the airport tower. Once airborne, the pilot will tune in the next Very High Frequency Omnidirectional Range (VOR) located along his flight path. Radio waves from these transmitters help the pilot establish his direction (azimuth). Meanwhile, the pilot has reported the actual time of takeoff to the next flight service station. Using the deviation indicator and the To-From indicator, the pilot can determine his position on course. Outbound from a VOR facility, Tactical Air Navigation (TACAN) can be used to check the aircraft location. Through airborne equipment called the interrogator, the pilot can ask the ground station (usually VOR and TACAN are located in the same building, VORTAC) the distance and direction to the station. If inclement weather obscures visibility, the aircraft will operate on Instrument Flight Rules (IFR). Consequently, the flight plan is changed from VFR to IFR. Air Route Traffic Control Centers (ARTCC) monitor and advise aircraft flying under these conditions. Remote Center Air Ground Communication Sites relay communications to the ARTCC until the aircraft is in radio range. Most of these centers are equipped with VHF and UHF radio transmitters and receivers and have standby generators. Radar at the center monitors the aircraft's progress, and this vital link in the air traffic control system is backed up by additional equipment and repair technicians. When the aircraft reaches its destination, Airport Surveillance Radar will monitor the plane's approach while Radar Approach Control will handle communications between the aircraft and airport. Under conditions of poor visibility it would have been necessary to make an instrument landing system (ILS) approach by means of localizer equipment. The Glide Slope indicator would have been used to determine the angle of descent. With better visibility, visual contact could have been made with the Approach Lights and Flashing Strobe Lights and a Visual Approach Slope Indicator could be used during the descent. On the runway, the ground radar continues to monitor the aircraft's

* V-9005 pp 102-113
* V-9013 pp 645-655
* V-9065 pp 141-190
*** V-9139 pp 225-235

progress. As can be seen from this cursory glance at avionics, piloting an aircraft is a cooperative enterprise between ground and aircrew personnel.

c. The continued success of air traffic control is vital to the future of civil aviation. Multi-billion dollar investments in modern transport aircraft, perhaps quadrupling the level of air traffic by 1980, are dependent to some extent on comparable advances in air traffic control. Moreover, the total number of new airports scheduled for construction in the 1970s will not be enough to handle anticipated expanded passenger traffic. Present airports and air traffic control facilities must expand to meet these added requirements. The FAA is deeply concerned over the situation, and Congress is also involved. Increased Government and civilian expenditures will be needed to solve the problems the airlines industry faces. Hopefully innovations such as all-weather landing systems, semi-automatic landing systems, color radar identification systems, collision avoidance systems, and fog dispersal devices will become feasible and/or widespread in the near future. Advances in avionics will be an important aspect in the aviation industry's attack on current airline problems.

5. SUGGESTIONS FOR TEACHING:

a. Suggested time: 2-3-4

b. Students may find some aspects of Chapter V rather complex. You must be prepared to answer questions they may have about air traffic control and air navigation electronic equipment. Additional illustrations of cockpit equipment, available in your reference library, may prove useful. Do not try to teach air navigation or expect your students to remember all the avionics equipment discussed in this chapter. The emphasis here is on communication between the aircraft and FAA facilities personnel. Simulated flight exercises using a tape recorder will aid student understanding and provide motivation for further inquiry. Be sure they understand the importance of air traffic control and the necessity for a vast network of electronic support.

c. There are several ideas under Things To Do, pages 117-118 of the text.

d. Air traffic control has become a frequent news item. Newspaper material about crowded air, aerial near misses or disasters, hijackings, air traffic controller slowdowns, and other problems

of air traffic control may prove to be focal points for discussion. Ask your students to use this information to suggest ways to improve future ATC operations and facilities.

e. Several variations of role playing ATC communications situations can stimulate interest in this block of instruction. Assign each student a call sign (e.g., Tom Jones could be Cessna 4595TJ, Janet King could be Cessna 4595JK, and so on for the whole class). Have them practice aircraft tower communications in pairs. They may even want to memorize the phonetic alphabet on page 100 of the text. Then you could tell the entire class that they're all airborne and you're ATC. Give a call sign with a question and have them respond. Another variation would be tape recording the radio calls between a tower and a pilot taxiing out for runup and takeoff. Students could play one or both parts. Variations are almost unlimited.

f. Col. Houston Longino (TN-71) has a small aircraft on a short pole attached to a controllable motorized vehicle. An airport layout is painted on large poster boards (it could be drawn on a floor). Then students are told to move the aircraft and make all proper radio calls. He even has them simulate takeoff, a traffic pattern, landing, and taxi back to park.

g. Students can simulate ATC traffic control on an overhead transparency. Airplane shapes can be moved similar to those in the traffic pattern or on a radar scope. Many situations can be developed and simulated.

h. Textbook corrections:

(1) Page 92, paragraph 5, line 1, change to read "---built during 1920 and 1921,---"

(2) Page 98, paragraph 3, last line, RUNWAY is misspelled.

(3) Page 99, paragraph 2, last line, change to read "---in the Airman's Information Manual (AIM)."

(4) Page 100, add at the bottom of the page: Figure 39. International Phonetic Alphabet and Code.

(5) Page 102, Fig 41, change the outbound radial from Oklahoma City from 144° to 145°.

(6) Page 105, next to last paragraph, last line, move period to end of the sentence.

(7) Page 107, Fig 46, writing on the figure is

WILEY
POST

TINKER
FIELD

ARDMORE

CESSNA
1594B

(8) Page 111, paragraph 7, last line, move period to the end of the sentence.

(9) Page 113, paragraph 5, last line, move period to the end of the sentence.

(10) Page 119, under Aircraft, should be Comet 1:47.

(11) Page 120, change INDENT to IDENT.

(12) Page 121, should be MegaHertz (MHz):99,104.

i. Student assignment:

Read pages 91-118.

6. INSTRUCTIONAL AIDS:

Films:

a. FAA

(1) FA 02-70 Area Navigation, 25 min, color, 1970.

(2) FA 02-72 Safety in the Skies Above All, 10 min, color, 1972.

(3) FA 06-71 Dusk to Dawn, 28-1/2 min, color, 1971.

(4) FA 07-72 Radar Contact, 29 min, color, 1972.

(5) FA 102 A Traveler Meets Air Traffic Control, 28-1/2 min, color, 1963.

(6) FA 129 To Save A Life, 13 min, color, 1961.

(7) FA 133 At the Other End of the Mike, 10 min, color, 1961.

(8) FA 701 The Inspectors, 25 min, color, 1965.

(9) FA 901 The Flight Service Station, 28 min, color, 1969.

(10) FA 902 Basic Radio Procedures for Pilots, 30 min, color, 1970. (This film is rated excellent)

(11) FA 903 From the Ground Up, 27 min, color, 1969.

(12) FA 906 The Controller-Computer Partnership, 7-1/2 min, color, 1969.

(13) FA 907 Today for Tomorrow, 14-1/2 min, color, 1969.

(14) FAC 122 Using the Airspace--Navigation and Communications, 20 min, color, 1966.

b. Piper Aircraft (see Chapter II this handbook)

This Could Be You, 27-1/2 min, color.

c. Univac Film Library
Advertising and Sales Promotion (pay return postage)
P.O. Box 500
Blue Bell, PA 19422

Arts III--A New Look At Air Traffic, 10 min, color, 1970.

d. USAF

(1) SFP 1428 Progress in Air Traffic Control, 20 min, color, 1966.

(2) TF 6114 A Traveler Meets Air Traffic Control, 31 min, color, 1963.

(3) TF 5693 What's My Traffic?, 25 min, B&W, 1964.

7. PROJECTS:

a. Have students build mock-ups of some of the equipment used in air traffic control and use them in classroom exercises.

b. Plan a flight using a sectional chart. Mark all ATC facilities to be used, show where radio calls would be made, and write in where ATC-operated equipment would be used.

8. FURTHER READING:

a. See Further Reading Chapter III this handbook, items a., b., and c.

b. FAA regularly publishes excellent free materials about FAA Operations and Air Traffic Control. Current items can be requested by writing to:

Federal Aviation Administration
Public Affairs Office
P.O. Box 25082
Oklahoma City, OK 73125

c. If your students are interested in researching radar further, two FAA publications are recommended: Radar Fundamentals (Q-6) and Secondary Surveillance Radar for Controllers (Q-4). These two publications are used at the FAA Academy in Oklahoma City.

d. VFR Exam-O-Grams No. 15, 16, 34, 36, and 43. Available free by writing to:

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch
P.O. Box 25082
Oklahoma City, OK 73125

IDEAS FOR IMPROVEMENT OF THE TEXTBOOK AND/OR INSTRUCTOR'S GUIDE
AND TEACHING TECHNIQUES MOST EFFECTIVE FOR THIS CHAPTER.
TO BE COMPILED AT END OF TEXT AND SENT TO JRC

CIVIL AVIATION AND FACILITIES